Joint GPS Combat Effectiveness

Joint Test and Evaluation (JGPSCE JT&E)

GYPSY ALPHA Final Results and GYPSY BRAVO Preliminary Findings

This briefing is Unclassified

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27 Feb 2002

JGPSCE

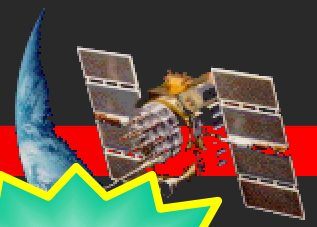
- Program Background
- GYPSY ALPHA
- GYPSY BRAVO
- Future Tests

Background - JT&E

- Find ways for the Warfighters to do their job better with today's equipment, organization and doctrine
- Provide better tools and ways to test
- Provide feedback to the acquisition and joint operations communities

How can we do better with what we have?

JT&E Cradle to Grave



Services provide: Government personnel, facilities, and O&M support.
DD,DT&E provides dollars for test specific support including contractor support

Nomination

From the Services, CINCs, OSD, or Defense Agencies

Feasibility Study

1 year

Joint Test and Evaluation

3-4 years

Results

JGPSCE - The Problem

Areas of Concern

- *Collateral damage*
- *Fratricide*
- *Tactics*
- *Targeting*
  - ➢ *How to test*
  - ➢ *How to train*

"GPS is essential to JV 2010"

....Navy Research Advisory Committee

JGPSCE Charter

- **OUSD/DTSE&E (now DS&TS) chartered JGPSCE, July 99**
- **Purpose: Address GPS vulnerability to ensure U.S. warfighting effectiveness in precision engagement**
- **Chartered for FY00-04**
  - **Measure impacts on joint operations at the task and mission level**
  - **Develop mitigations to restore capability**
  - **Develop GPS vulnerability test methodologies to improve future system acquisition**

Products

- Impact of GPS EW, EMI, and mitigations - CINCs, components, Air Land Sea Application Center, Joint Warfighting Center, and program offices
- Training inputs - Services
- Acquisition process improvements - Acquisition authorities
- Vulnerability assessment methodology inputs - Developmental and operational test agencies

JGPSCE Test Approach

- **Answer critical issues based on field tests**
- **Design quantifiable, repeatable tests**
  - **Primary objective is quantified data**
  - **Hold non-test variables constant to max extent**
  - **Achieve statistical significance when possible**
- **Conduct operationally realistic tests**
  - **Real warfighters using current TTPs**
  - **Approved doctrine, actual CONOPS**
  - **“Real” scenarios, threat laydowns**

Schedule

PHASE ONE
Small Scale Contingency

PHASE TWO
Limited Engagement

PHASE THREE
Major Theater War

GYPSY DELTA — *JOINT TASK FORCE EXPERIMENT*

GYPSY CHARLIE — *JOINT COOPERATIVE EVENT*

GYPSY BRAVO — *NAS FALLON & UTAH TEST AND TRAINING RANGE*

GYPSY ALPHA — *WHITE SANDS MISSILE RANGE*

Month → 3 6 9 12 3 6 9 12 3 6 9 12 3 6 9 12 3

FY00 | FY01 | FY02 | FY03 | FY04

GYPSY ALPHA

White Sands Missile Range NM

30 Oct - 18 Nov 2000

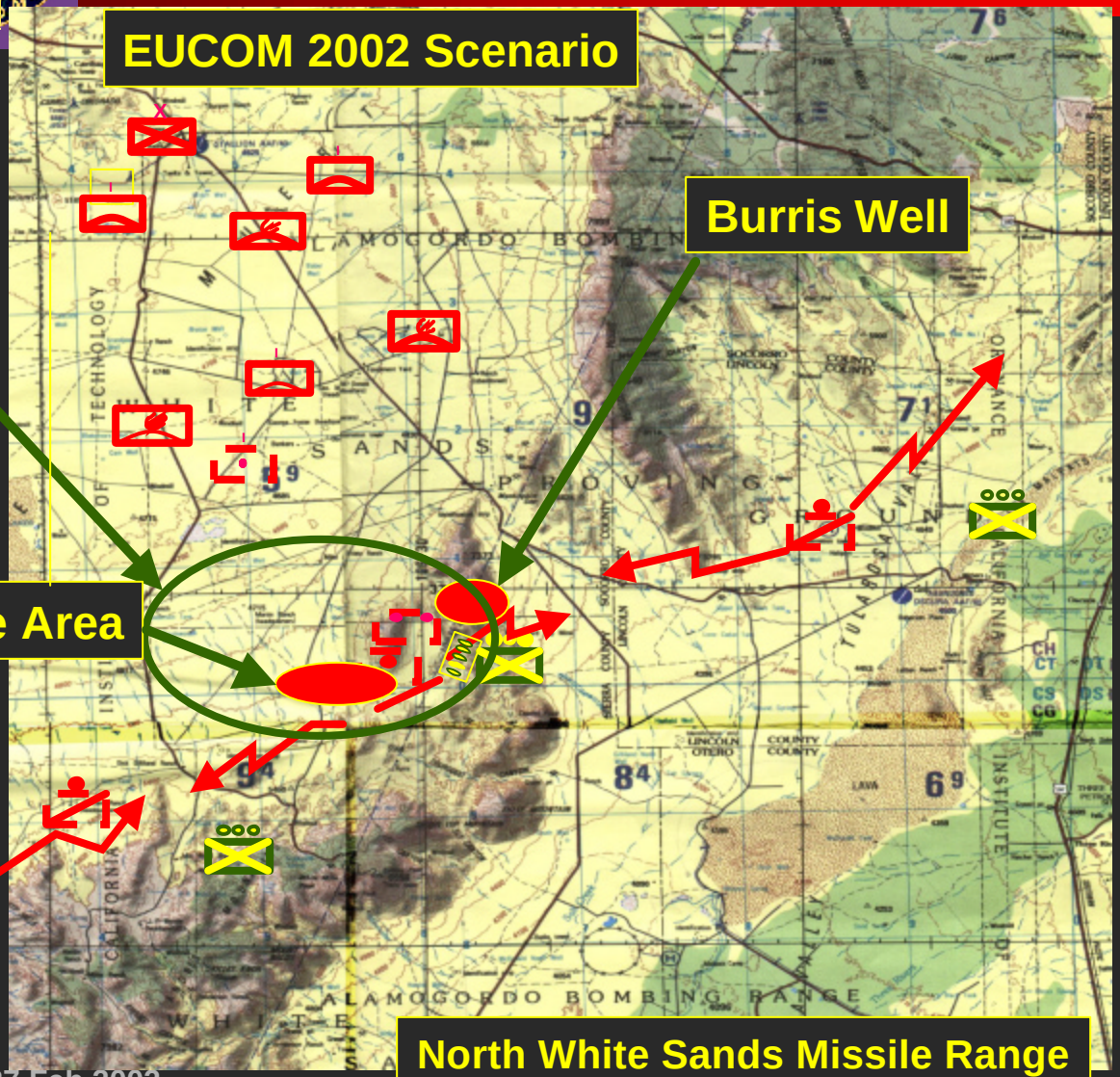
Test Scope

- Assessed the impact of GPS degradation and/or denial on Ground Reconnaissance Team operations
  - Tactical level evaluation
  - 3 conditions: GPS electronic warfare (EW), GPS electromagnetic interference (EMI), and no EW or EMI (baseline)
- Evaluated prototype GPS receivers for the GPS JPO

GA Test Participants

- Army Special Operation Force (SOF) detachment, Ft Campbell, KY (two reconnaissance teams)
- Army Explosive Ordnance Disposal (EOD) team as observer-controllers - 734 Ordnance Co, WSMR, NM
- Army UH-60 - CECOM, Ft Monmouth, NJ
- Marine EOD team - Marine Wing Support Squadron & Headquarters Squadron, MCAS Yuma, AZ (one reconnaissance team)
- Navy EA-6B - VAQ 134, NAS Whidbey Island, WA
- Navy F/A-18 - NAWC-WD, China Lake, CA
- Air Force HH-60G & MH-53J - 58 SOW, Kirtland AFB, NM

Ground Situation



GA Instrumentation

- WSMR Radar - Air Vehicle TSPI Reference
- PLGR(U) - Ground Team TSPI Reference
- GEMS and Area RF Monitors
  - Continuous Measurement of RF Environment
  - Four GEMS Units, Backpack Mounted
- MCDARS - Communication Systems Recording
- STARSHIP - Test Control and Playback

GA TSPI Reference

Ground Teams

Precision Lightweight
GPS Receiver - Upgrade (PLGRU)

Aircraft

Range Radar with
C-Band Transponder

GA Test Execution

Mission Summary

- 24 ground reconnaissance missions
  - Negotiate minefields
  - Find and destroy caches
  - Locate & ID targets
  - 5 helo infils (HH-60G or MH-53J)
- 4 EA-6B sorties
- GPS JPO-Sponsored Evaluations
  - 5 UH-60 sorties-- prototype receivers & simulated troop infiltration
  - 5 F/A-18 sorties-- prototype receivers & simulated PGM employment
- Numerous systems tested

GA Test Results

- Ground teams successfully employed alternate navigation techniques (e.g., map and compass) when PLGR was unusable
- Familiarity with PLGR operations varied greatly between the SOF and Marine EOD teams
- Rugged terrain environment did not pose a particularly challenging navigation problem to the teams
- Investigated GPS prototype receivers
  - Theoretical ability to acquire on L2 if L1 only is jammed
  - Theoretical increase in jamming resistance under simultaneous L1 & L2 jamming
- Investigated EA-6B Prowler effects on GPS L1 and L2 frequencies and on PLGR

GYPSY BRAVO

Part One

Fallon Range Training Complex NV

9 - 25 January 2002

GB Purpose

- **Measure the impacts on precision munitions effectiveness when launch platforms and weapons are exposed to GPS EW or EMI in tactical scenarios**
  - **F-16C employing GBU-31 (JDAM)**
  - **F-15E employing EGBU-15**
  - **F/A-18C/D employing AGM-154A (JSOW)**
  - **AH-64D employing AGM-114 (RF Hellfire)**

GB Test Approach

- **CENTCOM 2003 scenario**
  - **Threat scenario developed by JGPSCE & NGIC**
  - **Coordinated with NAIC, 527th Space Aggressors**
  - **Validated by NSAWC, DIA, CENTCOM**
- **Measure impacts of GPS EW/EMI**
  - **Part 1 - From prior to target acquisition through simulated weapon flyout - NAS Fallon, Jan 02**
  - **Part 2 - Analysis and prediction**
  - **Part 3 - From prior to target acquisition through weapon impact - UTTR, Aug 02**

GB Test Participants

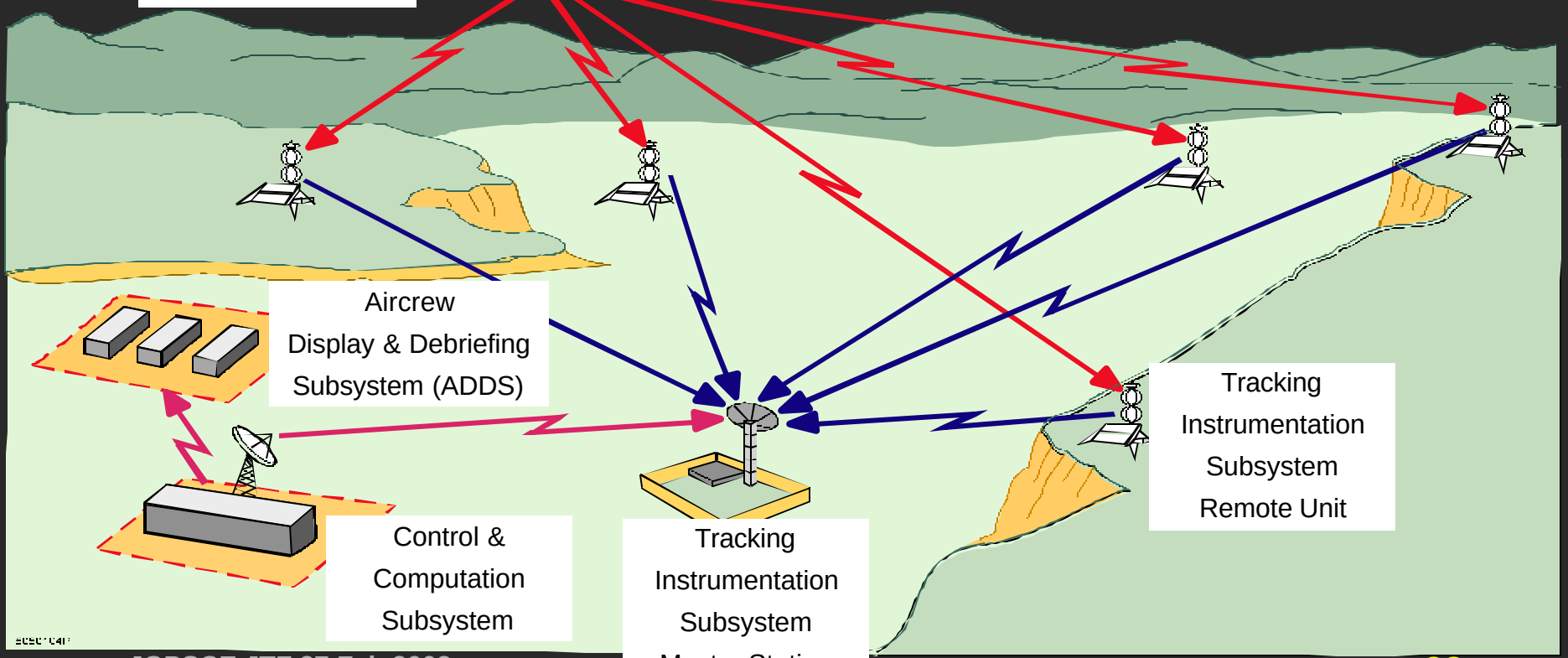
- Air Force F-16C and F-15E - 53rd Wing, Nellis AFB, NV
- Navy and Marine F/A-18C - CVW-2, NAS LeMoore, CA; NAWC-WD, China Lake, CA
- Navy EA-6B - Electronic Attack Wing, NAS Whidbey Island, WA
- Army AH-64D - ATTC, Ft Rucker, AL
- Air Force C-12J - 586th TS, Holloman AFB NM
- Telemetry vans and Instrumentation: 46th Test Wing, Eglin AFB FL; 588th RANS, Utah Test and Training Range, Hill AFB UT; JASSM SPO, Edwards AFB CA; Yuma Proving Ground, AZ
- White Force Control: Naval Strike and Air Warfare Center, (NSAWC) NAS Fallon, NV
- Red Force: NSAWC; 746th TS, Holloman AFB NM

GB Part 1 Instrumentation

- **TSPI Truth Reference**
  - **Tactical Aircraft Combat Training System (TACTS) for F-15E, F-16C, and F/A-18C**
  - **Advanced Range Data System (ARDS) for AH-64**
- **GPS EW/EMI Environment**
  - **C-12J GPS Environmental Measurement System (GEMS) - pre-test field characterization**
  - **AH-64D onboard GEMS**
- **Communications/Test Control - TACTS**

TACTS Range

Aircraft Instrumentation System (AIS) Pod



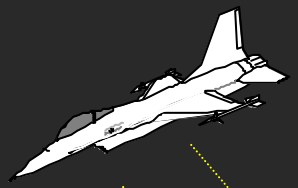
Aircrew Display & Debriefing Subsystem (ADDS)

Control & Computation Subsystem

Tracking Instrumentation Subsystem Master Station

Tracking Instrumentation Subsystem Remote Unit

GB F-16/JDAM Data Collection



EA-6B

JDAM Telemetry

1553 Bus Telemetry

Target

MOTAAS Van

JASSM Van

- MARS bus tape
- AVTR 8mm tape
- Crew Questionnaires
- Debrief video
- After Action Report
- Pre & Post AFMSS data

Decommutated Weapon Data in ASCII on CD

Decommutated Bus Data in ASCII on CD

JGPSCE Data Center

- TACTS / ADDS TSPI
- C-12 GEMS data

GB Part 1 Results

- 98 sorties flown (181 flight hours), 9-26 Jan 02
  - Captive carry only, 157 simulated weapons flyouts
- GB Part 1 Firsts
  - First GPS EW/EMI test of AH-64D, EGBU-15
  - First operational JDAM test with platform jammed
  - First JSOW test with platform jammed
  - First EA-6B tactics evaluation investigating GPS
- GB Part 1 Preliminary Findings
  - In most cases weapons employment was not impacted
  - Results of data analysis will be compared to observations
  - EA-6B tactics verified

FUTURE TESTS

GYPSY CHARLIE

- System-of-systems field test
  - Test the effects of GPS denial or degradation at the tactical level of warfare.
  - Expands previous unit level testing to explore integrated tactical operations for joint forces in a GPS denied/degraded environment.
  - Explore a Joint Tasks Force's ability to conduct sensor-to-shooter operations in a limited engagement scenario where GPS signal is denied or degraded.

GC Test Concept

- Adjunct to Roving Sands 2003 or similar event
- PACOM limited engagement scenario
- Tactical C3 units will direct and control ISR and strike assets assigned to accomplish reconnaissance and interdiction missions
- Hostile EW will follow a DIA/NGIC approved scenario
- Examine interference of GPS signal by own force communications, radar surveillance, and electronic attack
- Candidate Participants:
  - ISR: JSTARS, AWACS, Rivet Joint, GR/CS, Predator
  - C2: Air Operations Center, JSTARS, ABCCC, AWACS, CIC
  - Strike: F-15E, F/A-18C, F-16C, ATACMS

GYPSY DELTA

- Late 2003 field test
- Major theater war scenario
- Combined evaluation of tactical and operational level of war impacts caused by GPS EW and EMI
- Adjunct to USJFCOM joint experiment

Thank You !

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